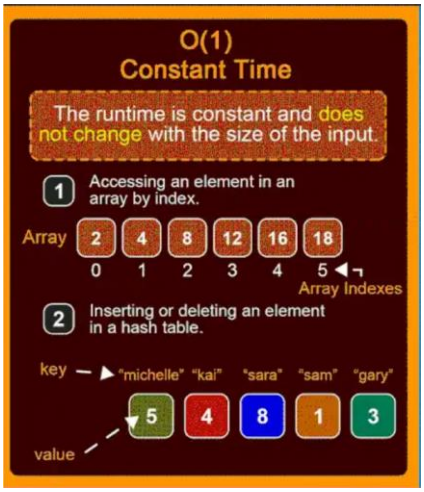
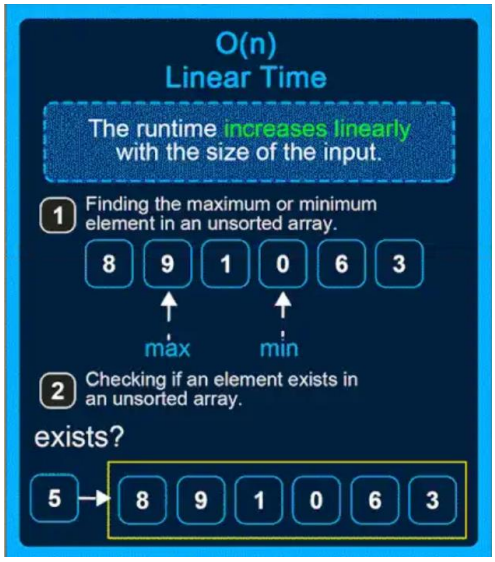
Big O Notation The Secret to Writing Efficient Algorithms:

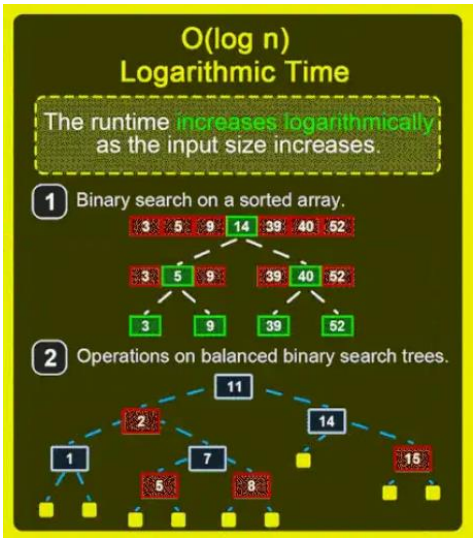
1. **O(1)**
   This is the constant time notation. The runtime remains steady regardless of input size. For example, accessing an element in an array by index and inserting/deleting an element in a hash table.



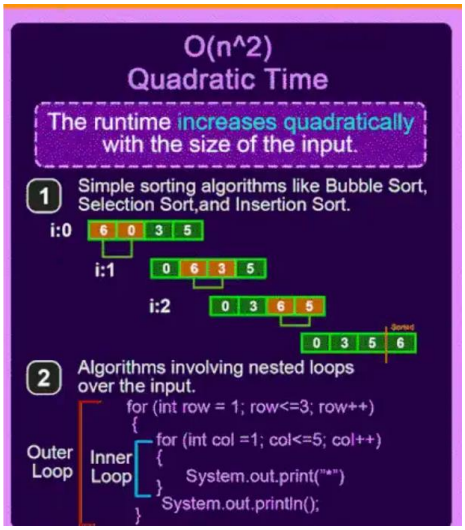
2. **O(n)**
   Linear time notation. The runtime grows in direct proportion to the input size. For example, finding the max or min element in an unsorted array.



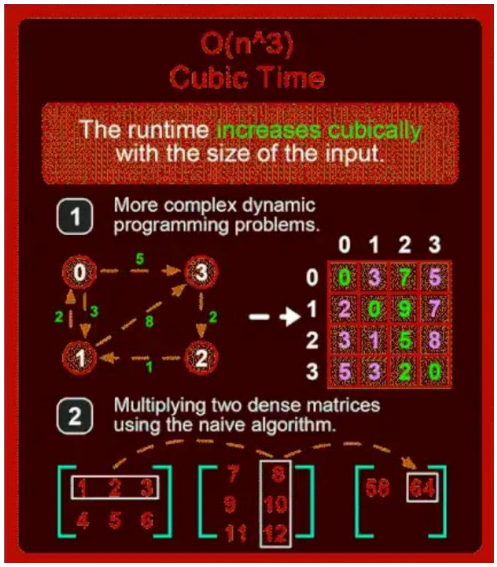
3. **O(log n)**
   Logarithmic time notation. The runtime increases slowly as the input grows. For example, a binary search on a sorted array and operations on balanced binary search trees.\



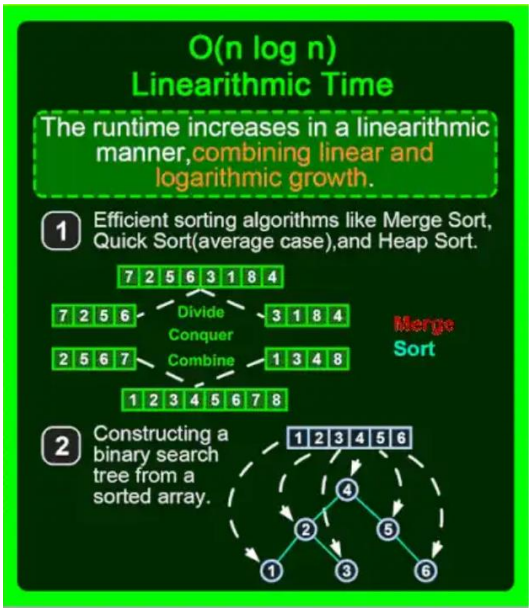
4. **O(n^2)**
   Quadratic time notation. The runtime grows exponentially with input size. For example, simple sorting algorithms like bubble sort, insertion sort, and selection sort**.**



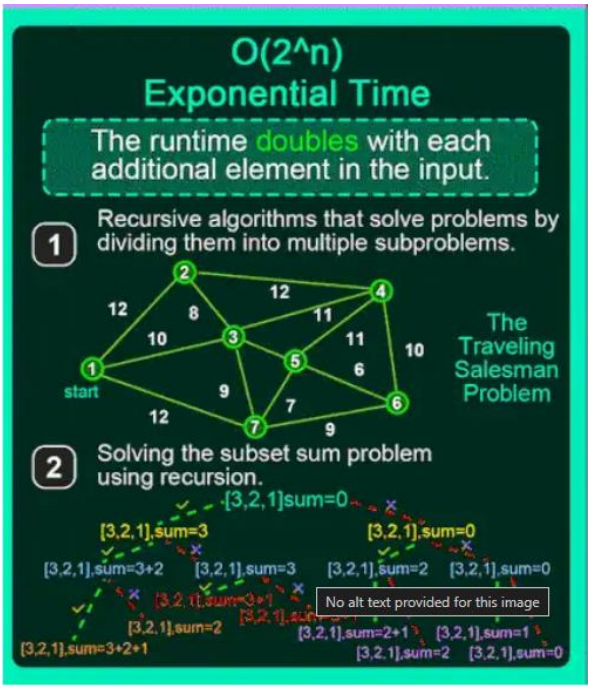
5. **O(n^3)**
   Cubic time notation. The runtime escalates rapidly as the input size increases. For example, multiplying two dense matrices using the naive algorithm.



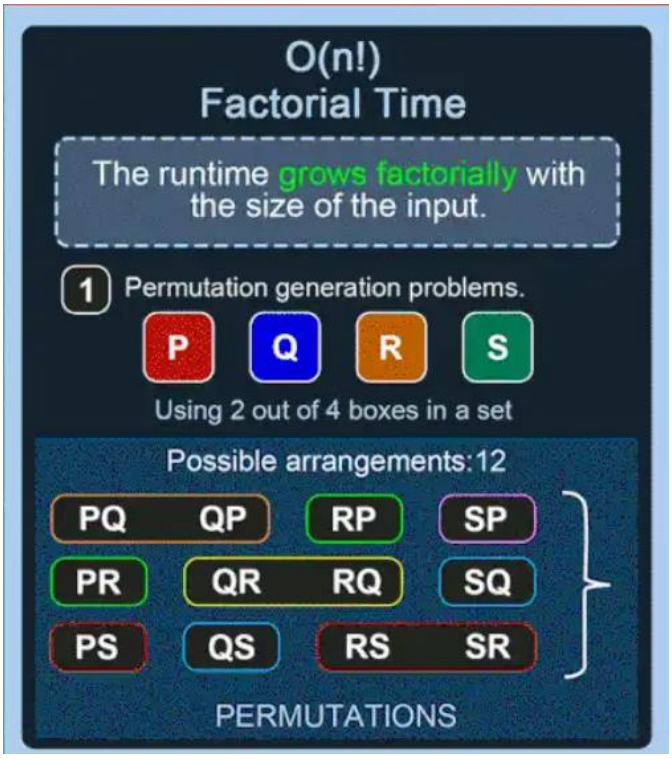
6. **O(n logn)**
   Linearithmic time notation. This is a blend of linear and logarithmic growth. For example, efficient sorting algorithms like merge sort, quick sort, and heap sort



7. **O(2^n)**
   Exponential time notation. The runtime doubles with each new input element. For example, recursive algorithms solve problems by dividing them into multiple subproblems.



8. **O(n!)**
   Factorial time notation. Runtime skyrockets with input size. For example, permutation-generation problems.



9. **O(sqrt(n))**
   Square root time notation. Runtime increases relative to the input's square root. For

example, searching within a range such as the Sieve of Eratosthenes for finding all primes up to n.